MEY . . . . PUTNAM (J. J.)

THE

Anatomy of the Mammal Brain.

BY

PROF. MEYNERT,

OF VIENNA.

ANALYZED BY

DR. J. J. PUTNAM,

OF BOSTON.

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II.

THE ANATOMY OF THE MAMMAL BRAIN.* BY PROF. MEYNERT, OF VIENNA.

STRICKER'S Manual of Histology, of which the American translation, edited by Dr. A. H. Buck, of New York, has recently made its appearance, contains a valuable contribution to the Anatomy of the Brain, from the pen of Prof. Theodor Meynert, of Vienna, a production which unfortunately the author's peculiar style and unusual manner of dealing with his subject, as well as the fact that it was of necessity greatly condensed, renders almost unintelligible to the general reader.

The anatomical statements are interspersed with frequent generalizations and hypotheses which are brilliant and interesting, although the evidence furnished us in support of them does not always strike us at first sight as entirely convincing. In the present sketch the headings of the sections will be set down in order, and a few of the more interesting facts and theories briefly enunciated.

GENERAL CONSIDERATIONS.

Prof. Meynert sees in the central nervous system a mechanism for receiving, storing up, and again transmitting, but not for originating excitations.

All excitations which affect the nervous system at all reach finally the cortex cerebri, upon which they may be said, in the geometrical sense, to be *projected*. The centripetal nerve-fibres through which this projection is accomplished are included, together with the centrifugal fibres which place the brain again in communication with the muscles, under the name of the *projection system*, in contradistinction to those systems of fibres which terminate with both their extremities in the cortex cerebri, and which serve to establish a functional unity between the different parts of that organ. These latter he calls the association systems.

Prof. Meynert adopts the usual division of the crus cerebri into basis (or pes) cruris and tegmentum cruris, of which the former springs chiefly from the corpus striatum and the nucleus lenticularis, among the cerebral ganglia, the latter from the thalamus opticus and the corpora quadrigemina. The basis cruris passes, after decussating in the region of the medulla oblongata, into the opposite lateral column of the spinal cord; the tegmentum passes without decussating, certainly not completely, into the antero-lateral column of the same side.

The tegmentum with its ganglia of origin are, he holds, concerned chiefly if not exclusively in the production of reflex movements, the exciting impulses thereto being derived through the sensitive cranial nerves, just as the impulses which call out the reflex phenomena produced by the gray matter of the spinal cord come through the sensitive spinal nerves. The basis cruris, on the other hand, with its ganglia, has alone to do with the transmission of the so-called voluntary impulses to the muscles.

The entire muscular system of the body (*i. e.*, the collective motor nerves) is represented then twice in the encephalon, once in the basis cruris and again in the tegmentum cruris.†

Early in the life of the individual, before the so-called manifestations of *will* have made their appearance, all movements are of reflex origin, and the cerebral lobes with the basis cruris cerebri and its ganglia have no share in their production. In

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* Comp. also the Sitzungsberichte der k. Akad. der Wissenschaften. Band LX. Heft III. Studien über die Bedeutung des zweifachen Rückenmarks ursprunges. Beiträge zur Kenntniss der centralen Projection der Sinnesoberflächen.

† Comp. also loc. cit. Studien ueber die Bedeutung d. zweifachen Rückenmarksursprunges, &c.

virtue of its connection with the ganglia of the tegmentum, however, the cerebral lobes acquire constantly conceptions of these co-ordinated reflex movements (Bewegungsvorstellungen) and use them again as voluntary impulses, which this time are sent to the muscles by way of the basis cruris cerebri and its ganglia.

Besides this indirect acquisition of impressions, the cerebral lobes receive direct impressions from the posterior spinal nerves, by way of a fasciculus of nerve fibres, which, in the cord, belongs to one of the posterior columns, decussates with its fellow at a point in the medulla oblongata just above the decussation of the anterior pyramid, as Clarke and others have described already, passes upwards, as the outermost fasciculus of the opposite anterior pyramid and basis cruris cerebri, and enters the posterior cerebral lobe without being interrupted by any intermediate ganglionic mass.

Furthermore, the posterior cerebral lobe receives a contribution of fibres from the retina by way of the tractus opticus, and from the Schneiderian membrane by way of the anterior commissure, and from the fifth pair by way of certain nerve tracts that pass off from the superior nucleus of that nerve which lies embedded in the gray matter surrounding the aqueductus Sylvii in the region of the superior pair of the corpora quadrigemina.

Corresponding to these functional differences, we find these two tracts, the basis cruris and the tegmentum cruris, with their respective ganglia, characterized by differences in point of development. In the lower mammals and in man at an early stage of development the tegmentum is large, and the basis cruris with the cerebral lobes for the two latter always go hand in hand in their development, comparatively small, whereas in the adult human brain the case is reversed.*

Injury to the basis cruris or either of its ganglia causes loss of voluntary power over the opposite half of the body, while injury to the ganglia of the tegmentum, as Prof. Meynert maintains, does not produce any such result (unless indeed indirectly).

He holds that in the cases in which extravasation into the optic thalamus alone has been reported as having caused hemiplegia, it would have been found on close examination that the immediately adjacent capsula interna, which is made up largely of fibres passing from the corpus striatum and nucleus lenticularis to the basis cruris cerebri had been injured at the same time.

Each hemisphere of the cerebellum is connected with the opposite hemisphere of the cerebrum; first, through the processes e cerebello ad corpora quadrigemina (properly ad cerebrum) which are to be traced, after their decussation in the region of the corpora quadrigemina, fairly into the medullary substance of the cerebral lobes—the corona radiata; and second, by way of the basis cruris and the processes e cerebello ad pontem.

It is certainly beyond a doubt that when disease of one cerebral hemisphere is followed by secondary changes in the cerebellum, as has occasionally been observed, it is the opposite hemisphere of the latter organ which becomes affected.

The posterior columns of the spinal cord are to be traced, as will be shown, into the corpus restiformis and cerebellar hemisphere of the opposite side.

	Man.	Ape.	Deer.
* Height of basis comp. with that of tegmentum	1.1	1.3	1.5
Weight of cer. lobes comp. with that of entire brain	78%	70.8%	62%
Weight of nuclei caudatus et lenticulatis comp. with that of entire caudex cerebri	50%	40%	33.3%
Weight of thalami opt. comp. with that of entire caudex	19%	22.9%	30%

The different divisions of the brain are now taken up for more detailed examination, in the following order :—

1. The cerebral lobes.

The great motor cerebral ganglia, the corpus striatum and the nucleus lenticularis, receive their fibres for the most part from the anterior and parietal lobes toward which by far their largest extremities are directed. The corpus striatum especially dwindles away rapidly as it approaches the occipital and temporal lobes. In this connection the experiments of Fritsch and Hitzig are worthy of notice, in which they succeeded, by irritating certain defined districts of the cortex of the anterior lobe, in setting in contraction certain definite groups of muscles on the opposite side of the body.

The posterior and temporal lobes, on the other hand, are rather sensitive regions. They are in direct communication, as has been stated, with the posterior spinal nerves, the tractus opticus and the lobus olfactorius, as well as with the fifth pair of cranial nerves. They are, further, more closely connected than any other regions of the cerebral hemispheres with the ganglia of origin of the tegmentum. The anterior commissure seems to constitute a real olfactory chiasma. It appears to contain true commissural fibres for the two hemispheres and others for the two lobi olfactorii, besides uniting the olfactory lobe of one side with the posterior cerebral lobe of the other.

2. The basis cruris cerebri, with its ganglia.

Corpus Striatum.—The nerve cells of the corpus striatum are of two general sizes: 1st, large multipolar cells, 30 μ. (μ. = 0.01 mm.) in length; 2d, small, also multipolar cells, only 15 μ. in length. In consideration of the fact that the basis cruris, which springs largely from this ganglion, suffers a great reduction in size in passing through the pons Varolii, and in view of certain direct histological evidence, it is probable that the basis cruris as originally constituted contains a system of fibres which enter into communication with the nerve cells of the pons and are switched off through the opposite crus pontis into the cerebellum, and it may be that these small cells of the corpus striatum receive the central extremities of this system of cerebellar fibres.

3. The tegmentum cruris cerebri, with its ganglia.

Thalamus Opticus.—Its chief cerebral connections are with the middle and posterior lobes. Its extensive connections with the tractus opticus need not be referred to.

Corpora Quadrigemina.—Attention may be called to a system of fine, straight fibres with nerve cells intercalated in their course, which radiate outwards from the gray matter surrounding the aqueduct of Sylvius. Their function may be to place the nucleus of the third pair, the motor oculi, under the influence of excitations which originate in the retina.

As stated above, a certain group of nerve cells, which gives rise to the descending root of the 5th pair, occupies a lateral position in this central tubular gray matter, and sends upwards communicating tracts toward the posterior cerebral lobe, some of which enter into communication on the way with certain large nerve cells, which bring them probably into communication with the motor tracts of the tegmentum.

Each thalamus opticus as well perhaps as each of the other ganglia of origin of the tegmenta send fibres both to the tegmentum of the same side, and that of the opposite side, and this arrangement, together with the fact that in these ganglia [illegible] tracts from two important sensitive regions are brought into the

closest relationship with the central extremity of a good part of the future antero-lateral columns of the spinal cord, further characterize the tegmentum with its ganglia, in opposition to the basis cruris with its ganglia, as a tract well fitted for giving rise under the influence of an external excitation to coördinated reflex movements, even such as require the innervation of unsymmetrical muscles of opposite sides of the body.

4. The region occupied by the interlacement of the pedunculi cerebelli, with the projection system.

The proc. e cerebello ad corp. quad. and ad pontum have already been disposed of.

The pedunculi inferiores with the posterior tract of the projection system.

The most interesting part of this section relates to the formation of the posterior spinal columns (*i. e.*, the funiculi gracilis et cuneatus) from the opposite pedunculi cerebelli, a process which Professor Meynert, following the lead of Deiters, describes as follows:—

Each corpus restiformis (outer division of the pedunculus) resolves itself gradually into fibræ arcuatæ, which run forward through the substance of the oblongata on the same side, traverse the olivary body of that side, then cross the median raphé, and enter into connection either with the nerve cells of the opposite olive, or with the scattered cells lying posterior to that nucleus. Finally, from these cells fibres pass backward to the funiculi gracilis et cuneatus, which at that level are inflated with ganglionic matter. (For details v. orig.) The facts that justify this position are, chiefly:

1. That atrophy of one cerebellar hemisphere is not unfrequently followed by atrophy of the *opposite* olivary body.

2. That hand in hand with the appearance and gradual increase in size of the funiculi gracilis et cuneatus, the corpora restiformia shrink in size and finally disappear.

3. The observed course of the fibræ arcuatæ. The funiculi grac. et cun. do not make a part of the original pedunculus cerebelli, but are a secondary formation. The inner division of the pedunculus is really made up of the central prolongation of the nervus auditorius.

5. The mode of origin of the cranial nerves from the fifth to the twelfth.

In regard to this section it is only necessary to say that Prof. Meynert considers these nerves, in common with all the nerves of the body, to be represented once in the basis and again in the tegmentum cruris cerebri. Such connection can indeed be made out more or less satisfactorily for all except the nervus auditorius, which is traceable into both hemispheres of the cerebellum, which it reaches principally by way of the inferior peduncles, and to the cerebellum alone. The mode or the fact of an indirect connection with the cerebral lobes must be left undecided.

6. The cerebellum.

7. The transition from the structural type of the medulla oblongata to that of the spinal cord. J. J. P.

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